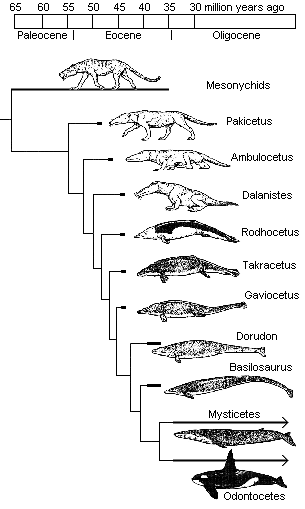
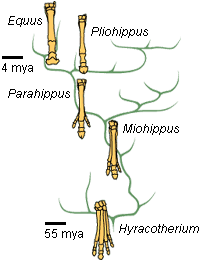
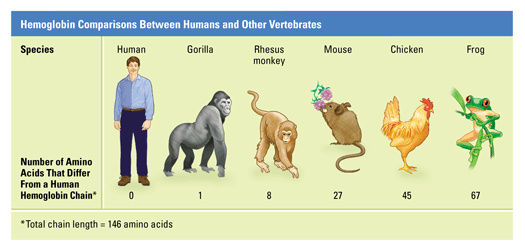
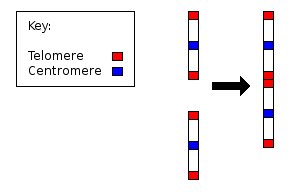
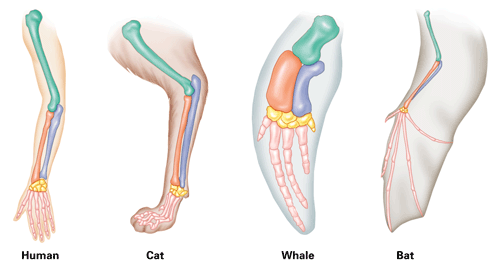
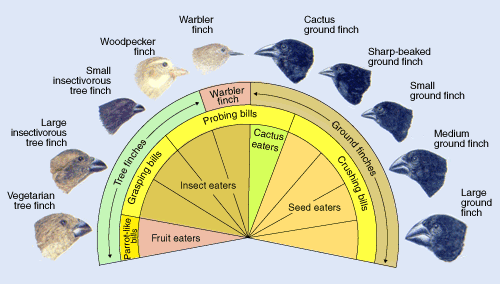
**Categories of Evidence for Evolution – Teacher Notes**

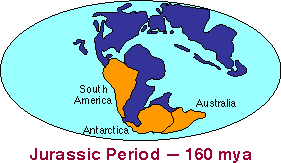
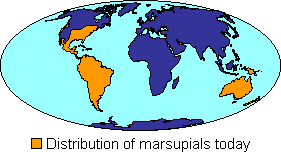
1. Fossil Evidence
   1. Whale ancestor fossils – land mammal to whale, nostrils moved back, legs shortened becoming fins, etc.
   2. Horse ancestor fossils – foot changed from 4-toed dog-like animal living in the woods to a long-legged, hooved, grass-eating horse.
2. DNA/Molecular Evidence
   1. **Closer similarities in DNA sequence** among species that look to be more closely related or share a more recent common ancestor. (Human & Chimp DNA is 98% identical)
   2. **Hemoglobin protein** **comparisons** - carries O2 around in our blood. It is made up of 146 amino acids that are put together from instructions in the DNA code. A comparison of the sequence of hemoglobin amino acids between various animals is shown below:
   3. 24 pairs of chromosomes in ape 23 pairs of chromosomes in humans (chrom. #2 in humans looks to be two chromosomes fused together)
3. Anatomical Evidence
   1. Homologous structures – similar structures in species sharing a more recent common ancestor

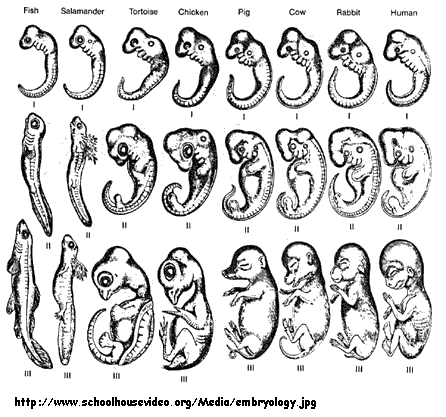


* 1. Vestigial structures – structures left over from an ancestor; they now serve very little purpose if any at all.
     1. Ostrich wings
     2. Whales – undeveloped, unused leg and hip bones.
     3. Humans – goosebumps, appendix, muscles to move the ears, tailbone, deactivated L-gulonolactone oxidase gene (makes an enzyme in most other mammals that can make Vit. C)
     4. Infants’ instinctive grasp – used by other primates with more hair so that infants could cling to their mothers if they needed to run away from danger.
     5. Non-functioning eyes of Ganges River Dolphin, Blind Mole Rat, Cave Salamander, and others who no longer benefit from sight.
  2. Mimicry– animals that look to be mimicking another animal in order to avoid predators.
     1. Viceroy butterfly looks to have evolved to mimic the poisonous Monarch butterfly
     2. Milk snake looks to have evolved to mimic the deadly coral snake
     3. Camouflage – is a form of mimicry of surroundings.
     4. Lots more…

1. Evidence from Geographical Distribution – data about presence or absence of species on various continents or islands.
   1. Adaptive radiation on the Galapagos Islands – from the ancestral seed-eating finch species on the mainland, many of the 13 island-inhabiting species look to have evolved different beak shapes that make them better adapted to food sources on their island.



* 1. Continental distribution of organisms
     1. Ostrich, emu, and rhea – similar birds on different continents, had time to evolve different traits after the split-up of Pangaea
     2. Before human colonization, the only mammals in Australia were marsupials. Also, native marsupial fossils are found in Antarctica and marsupials are in South and North America.
  2. Oceanic islands vs. continental islands – the latter used to be connected to the mainland and exhibit a variety of terrestrial mammals. Oceanic islands like the Galapagos and the Hawaiian Islands do not have native terrestrial mammals (sometimes have bats and seals)

1. Embryological Evidence – Darwin considered the evidence from embryology to be “by far the strongest single class of facts in favor of” his theory. If you compare early embryos from various classes of vertebrate animals the similarities indicate descent from a common ancestor. As new structures evolved these would have been tacked onto the end stage of embryonic development so as not to disrupt normal organ system development and other complex body systems.